French and German. Many other instances might be given of the thorough character of the work being done, but those cited will serve to show that the alumni of the Institute receive an education which is of service in assisting the development of American industries.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, February 9.—Annual General Meeting.—Prof. Lodge, F.R.S., President, in the chair.—The following officers were elected to form the Council:—President, Prof. Lodge; Vice-Presidents (who have filled the office of President), Dr. Gladstone, Prof. Carey Foster, Prof. Adams, Lord Kelvin, Prof. Clifton, Prof. Reinold, Prof. Ayrton, Prof. Fitzgerald, Prof. Rucker, Sir W. Abney, Mr. Shelford Bidwell; Vice-Presidents, Mr. Blakesley, Mr. Boys, Prof. Everett, Mr. Griffith; Secretaries, Messrs. H. M. Elder and W. Watson; Foreign Secretary, Prof. S. P. Thompson; Librarian, Mr. W. Watson; Treasurer, Prof. Callendar; other members of Council, Prof. Armstrong, Dr. Atkinson, Mr. W. Baily, Prof. Glazebrook, Mr. E. H. Griffiths, Mr. S. Lupton, Prof. Perry, Mr. Swinburne, Prof. Threlfall and Mr. J. Walker.—Prof. Lodge delivered his Presidential address, on the controversy concerning Volta's contact force. Those who take a metallic view of the Volta contact force are accustomed to deny that the Peltier evolution of heat measures the local E.M.F. existing at a junction; they assert that it measures the rate at which that same E.M.F. varies with temperature. In the thermodynamic equation connecting the Peltier effect with the variation of E with temperature, the E which varies is not necessarily that at the junction considered, but is the total E.M.F. of the circuit. The reversible heat at a specified junction is a measure of the metallic E.M.F. located there. Those who say it is a temperature variation of the E.M.F. beg the question by locating the whole E.M.F. of the circuit at the particular junction they are considering, usually an interface of zinc and copper. At a chemical junction the E.M F. is not purely thermal, and hence is not measured by the Peltier effect; it is chiefly of chemical origin, and is calculable from the energy of combination of the materials on either side of the boundary. At a metallic junction there is no such chemical potentiality. A strong current may be passed across a zinc-copper junction for years and no brass is formed. It is, therefore, improbable that the chemical affinity of zinc for copper is the propelling influence which causes the E.M.F. located at such a junction. In showing the Volta effect experimentally, a trace of liquid can act detrimentally by forming a conducting bridge between the plates, across which the bulk of the electricity passes as the metals are being separated. The safest and clearest mode of expressing the Volta effect is that it consists in an opposite charge acquired by dry zinc and copper while in metallic contact, a charge which results from an E.M.F. of fixed value, and is controlled solely by this E.M.F. and electrostatic capacity. It is undeniable that the order of the Volta force can be calculated from the differential heats of combination of the metals for oxygen, although it is doubtful whether it can be calculated from the heat of formation of brass. The opposing sides of the old controversy used to be called contact theorists and chemical theorists. Now the opposite sides are involved both in contact and in chemical views. It is a question of which of several contacts is the effective one, and what kind of chemical action or affinity is the active cause. Is it the contact and chemical affinity across the metal-metal junctions, or across the metal-air junctions? The opposite sides are thus metallic and dielectric. The metal-air force is of the order volts; the metal-metal force is of the order milli-volts. When a piece of zinc is put in contact with a piece of copper, the oxygen atoms which surround these bodies move slightly away from the copper and approach slightly nearer to the zinc. These slight motions produce the whole Volta effect. All that is necessary for the Volta effect is the inherent film on the surface. All the rest of the gas is mere dielectric, and might be substituted by a vacuum. It was proposed by Prof. Perry and seconded by Prof. Armstrong that a meeting should be held to discuss the address. The meeting was adjourned until February 23.

Mineralogical Society, January 23.—Prof. A. H. Church, F.R.S., President, in the chair.—Mr. E. G. J. Hartley, in continuation of his investigations on the constitution of the natural arsenates and phosphates, gave the results of analyses of beudantite, which lead to the new formula:

$$3PbSO_4.2Fe(P, As)O_4.6Fe(OH)_3.$$

Prof. H. A. Miers found by optical examination that the mineral was probably not uniaxial, but pseudorhombohedral.—Mr. G. T. Prior described rock-specimens from the Little Island of Trinidad, S. Atlantic, which were collected by the Ross Antarctic Expedition. They consisted mainly of phonolites, with nephelenite and limburgite.—Mr. W. Barlow contributed a paper on a new method of deriving the thirty-two classes of crystal symmetry, which, it is stated, is more rigorous and at the same time simpler and more concise than the solutions hitherto given.—Mr. R. H. Solly exhibited crystals of dolomite from the Binnenthal, in which the tetartohedral character was well displayed.—Mr. A. L. Hall described new forms on crystals of copper-pyrites from Cornwall.

Geological Society, January 24.—W. Whitaker, F.R.S., President, in the chair.—Fossils in the University Museum, Oxford: II.—On two new genera and species of Crinoidea, by Prof. W. J. Sollas, F.R.S. The first genus and species are founded on two calyces in the University Collection and three in the British Museum; all the specimens come from the Carboniferous Limestone. The arms and stem are at present unknown. The genus in general character and structure recalls *Platycrinus*, but the incorporation of the costal and distichal plates in the calyx affords a very obvious distinction. The analysis of the calyx, however, suggests the Melocrinidæ, from the members of which it is chiefly distinguished by the comparatively small size of the costal and distichal plates. The new genus is a truly annectant form uniting the Melocrinidæ and the Platycrinidæ, and may be indifferently associated with either. The second genus and species are founded on a specimen in the Grindrod Collection, obtained probably from the Silurian rocks, but from a locality not known, possibly Dudley. In general appearance it resembles an elongated form of *Pisocrinus*, particularly in its calyx, but the arms are those of a Heterocrinid. This conjunction of characters, though rendering necessary a revision of the definition of the Pisocrinidæ, cannot be regarded as bringing this family appreciably nearer to the Heterocrinidæ, which are fistulate, while the Pisocrinidæ, so far as known, are not.—Fossils in the University Museum, Oxford: III.—A new worm-track from the slates of Bray Head, Ireland, with observations on the genus *Oldhamia*, by Prof. W. J. Sollas, F.R.S. The curious marking known as *Oldhamia* have not been hitherto recorded from other than the Lower Palæozoic rocks, although they have a wide distribution in space, being found in Ireland, in the Ardennes, in Brabant, in America, and possibly in Norway. While the organic nature of *Oldhamia* was scarcely a matter of doubt in the minds of the earlier writers, there existed a great diversity of opinion as to its place in the organic world, and it was placed by different observers among polyzoa, hydrozoa, and plants, respectively. The microscopical observations made by the author prove that *Oldhamia* is not the remains of an organism, but merely a marking in the rock, though one which might be, nevertheless, of organic origin.—Contributions to the Geology of British East Africa: Part II.—The geology of Mount Kenya, by Dr. J. W. Gregory. The three main zones of Kenya are characterised by different geological features. The long slope of the forest-belt consists in the main of volcanic ash, though the remains of secondary parasitic craters occur in it. The Alpine zone consists of coarser ash, agglomerates, and tuffs, interbedded with lava-flows and traversed by numerous dykes, with the remains of some secondary centres of eruption. The third zone, or central peak, consists of the plug which choked the central vent, of beds of agglomerate, and the thick proximal ends of the great lava-flows.—Contributions to the Geology of British East Africa: Part III.—The elæolite-syenite and fourchites intrusive in the coast series, by Dr. J. W. Gregory. The rocks described in this paper were given to the author by Mr. C. W. Hobley. Mount Zombo, situated in long. 39° 13′ E. and lat. 4° 26′ S., and 1519 feet high, is a massif of coarse-grained elæolite-syenite, consisting of anorthoclase, elæolite, usually allotriomorphic, and ægyrine. The rock must occur in the belt of Duruma Sandstone, unless the fossiliferous Jurassic shales run westward up the low valley of the Umba River. The sedimentary series on the coast-lands of British East Africa and Usambara are provisionally arranged by the author as follows: (5) Pleistocene reefs, limestones, alluvium, and laterites; (4) Jurassic shales and sandstones; Kimeridgian, Oxfordian, and

Callovian; (3) Possibly a pre-Jurassic part of the Duruma Sandstone; (2) Magarini sandstones; ?Triassic; (1) Sabaki shales; Upper Carboniferous.

MANCHESTER.

Literary and Philosophical Society, February 6.—Prof. Horace Lamb, F.R.S., President, in the chair.—On the conditions of propagation of a solitary wave, by R. F. Gwyther. In order to obtain mathematical formulæ capable of expressing in a few terms the equality of surface pressure over the long stretches of the solitary wave, the wave is regarded as being mainly supported by the pressure on the outskirts, any defect in the equality of pressure over the crest being looked on, under certain conditions, as overcome by a slight readjustment of the particles. Taking in $x+iy$ a term of the form $\tan hm\frac{(\phi+i\psi)}{c}$, it is shown that the results agree closely with the experimental results of Scott Russell.—On the motion of the particles in certain cases of steady fluid motion, by R. F. Gwyther. It is shown that the solution of the Lagrangian equations takes the form $x+iy=f(u+ib)$, where u is to be determined in terms of a, b, and t, by a quadrature.—On internal migration in England and Wales, 1881–91, by Prof. A. W. Flux. An account is given of the results of an examination of the net inward and outward movement in each registration district of England and Wales in the interval between the censuses of 1881 and 1891. The movement of the two sexes separately was taken, as differences in intensity and direction for males and females were not infrequent. Of the 54 registration counties (the Ridings of Yorkshire being separately considered), 40 showed net efflux for both sexes, and 7 others for one of the two sexes; of the 632 districts 124 only showed net influx of population taking the sexes together, this figure being reduced to 119 for males and raised to 136 for females. The net movements within the various counties involved a transference of about 304,000 males and 350,000 females from one district to another. Movement from a district in one county to one in another county involved a transference of about 172,000 males and 230,000 females, whilst some 418,000 males and 201,000 females left the country. The previously observed greater migratory tendency of the female seems at any rate partly due to the fact that when migration is tested by records of birth-places, the excess of migratory males are not included, owing to their removal beyond the limits of the kingdom. Measuring intensity of movement by the proportion of net migration to mean population, the absorption is most marked in London suburbs, and in those of some provincial towns in only a slightly less degree, and especially is marked in conveniently situated watering-places at the seaside, Bournemouth heading the list. The absorption into growing industrial towns is less strongly shown than might have been anticipated. These movements indicate some amelioration of the evils of life in crowded cities. The districts from which efflux has been strongest are found in the south-west, in Wales, on the Scotch border, and in north-east Yorkshire and Lincolnshire. A cartogram illustrating the movements was exhibited.

DUBLIN.

Royal Irish Academy, January 22. — Dr. Benjamin Williamson, F.R.S., Vice-President, in the chair.—Rev. W. R. Westropp Roberts, F.T.C.D., read a paper "On the Reduction of the Integral $\int\frac{\phi(z)\,dz}{\psi(z)\sqrt{f(z)}}$ to a number of other Integrals of the form $\int\frac{dz}{(z-n)\sqrt{f(z)}}$, where $\phi(z)$ and $\psi(z)$ are rational and integral functions of z and $f(z)$, a polynomial of the degree $2m$." The writer showed, in the first instance, the dependence of the above integral on $2m-1$ Integrals $I_0, I_1, \ldots I_{2m-1}$, and others of the form $L(z, n)$, having previously adopted the notation $I_r\equiv\int\frac{z^r dz}{\sqrt{f(z)}}$, $L(z,n\equiv\int\frac{dz}{(z-n)\sqrt{f(z)}}$, r being an integer. These $2m-1$ Integrals $I_0, I_1, \ldots I_{2-m}$ are ultimately shown to depend on Integrals of the form $L(z, n)$, in which n is specially related to the roots of $f(z)=0$. The result finally arrived at is that there is but *one* class of elementary Integrals, as the general Integral discussed in the paper can, in all cases, be made to depend on a number of others of the form $L(z, n)$.—Prof. J. P. O'Reilly read a paper on the Epidiorites of Killiney Park, Dublin county. He called attention to the description of the locality given in the Memoir of the Geological Survey of Ireland descriptive of the district, and pointed out that no mention is made therein of these rocks, although reference is made to those met with in Howth and other parts of the district. Considering the fine exposure shown at Killiney Park, and the accessibility of the point, he thought it desirable to make a map of the point where the rocks crop out, showing their connection with the micaschists; which map was submitted with the paper. He also had analyses of the Epidiorite and of the enclosing micaschists made, and gave them in the paper. He called attention to the occurrence of similar micaschists at Bray Head, and suggested the possibility that the Killiney Park rocks may be the same beds as those of Bray Head, but in a much more advanced stage of metamorphosis.

PARIS.

Academy of Sciences, February 5.—M. Maurice Lévy in the chair.—Calculation of the orbit of a comet of which the geocentric movement is considerable, by MM. O. Callandreau and G. Fayet. Although the calculations of the orbits of the minor planets are sufficiently exact to enable the asteroid to be easily traced from day to day, considerable differences arise between the actual and calculated positions of some of the newer comets. A simplification of Olbers' method is suggested, which, with the aid of the auxiliary table suggested by M. Radau, gives very easily a good approximation.—The localisation, elimination and origin of arsenic in animals, by M. Armand Gautier. The amounts of arsenic normally present in 100 grams of the fresh organ are, for the thyroid gland, 0·75 mgr.; the mammary gland, 0·13 mgr.; for the brain, trace or nothing; thymus gland, a distinct trace, not estimated; for skin, milk, and bone, decreasing traces. The liver, kidney, spleen, muscles, testicles, pituitary gland, pancreas, mucous membranes, cellular tissue, salivary glands, subrenal capsules, ovaries, urine and faces contain no trace of arsenic. With the view of ascertaining the possible sources of arsenic in the food supply, various food stuffs were carefully examined for this metalloid: bread, meat and fish contained absolutely none, eggs gave a very doubtful trace. The author discusses the medico-legal aspect of the question.—Attempt at a mechanical theory of mountain formation. Progressive displacement of the terrestrial axis, by M. Marcel Bertrand. The view is put forward that the solid crust to the earth yields slowly to the pressures acting upon it, exactly as a liquid would do, except that the duration of the motion, instantaneous for a fluid, is exceedingly slow in the case of a solid.—On a disease of the grape-vines of the Caucasus, by MM. Prillieux and Delacroix. Previous workers on the outbreak of vine disease in the Caucasus, in 1896, have ascribed the results as due to the fungus of black rot (*Guignardia Bidwelli*), but closer examination has shown that it is another species of *Guignardia*, which corresponds to *Phoma reniformis*, which is the cause of the Tiflis disease, to which the authors attribute the name of *Guignardia reniformis*.—Observations of the comet 1899 IV. (Temple, 1873 ii.) made with the large equatorial at the Observatory of Bordeaux, by MM. G. Rayet, Féraud and Esclangon.—On the second voyage of the *Princess Alice II.*, by S. A. S. Prince Albert of Monaco.—Study of the variation of latitude at the Observatory of Teramo, Italy, by M. Jean Boccardi. The measurements were carried out by the method of Horrebow-Talcott, with an instrument of Troughton and Simms of 75 mm. aperture. For four different pairs of stars the variations of latitude found were 1″·00, 0″·84, 0″·67, and 0″·98 respectively.—On a class of transformations, by M. J. Clairin.—On the determination of all the algebraic surfaces of double circular generation, by M. Eugène Cosserat.—On anharmonic algebraic equations, by M. Antonne.—On groups of isomorphisms, by M. G. A. Miller.—On vectorial masses of discontinuity, by M. André Broca.—The X-rays and discharge: generalisation of the notion of kathode rays, by M. G. Sagnac. A sealed note deposited July 18, 1898.—Contribution to the study of stratifications, by M. H. Pellat. Some experiments designed with a view to test the hypothesis that the stratifications produced in a Geissler tube are due to the interference of direct and reflected electric waves. The result was to negative this hypothesis, there being apparently neither a reflected electric wave nor electric oscillations.—On the metallic crystallisation by electrical transport of certain metals in distilled water, by M. Thomas Tommasina.—On the surface tension of some organic liquids, by MM. Paul Dutoit and Louis Friderich. Measure-

ments are given of the temperature coefficient of surface energy for a large number of liquids, by Ramsay and Shields' method. The average value of the coefficient found was 2·12, rising to 2·3, for hydrocarbons containing two benzene rings, and to 2·35 to 2·50 for the anilines. The general results confirm the earlier work of Ramsay and Shields on the same subject.—On the volumetric estimation of hydrogen and chemical tensions, by M. Alb. Colson. Precipitated silver oxide, dried *in vacuo* without heating, is readily acted upon by hydrogen, slowly at ordinary temperatures, and more rapidly at 100° C., the absorption being so complete in the latter case that it suffices for the volumetric determination of hydrogen in a gaseous mixture, since methane and ethane are unattacked under the same conditions. The silver oxide behaves as though it had a definite vapour pressure, the hydrogen apparently acting upon this vapour.—Action of strong ammonia solution upon the iodide of mercurdiammonium, by M. Maurice François. By the action of strong solutions of ammonia upon $HgI_2.2MH_3$, the iodide Hg_2NI is formed, the reaction being reversible.—On the borates of the magnesium series, by M. L. Ouvrard Definite tribasic borates of manganese, cobalt and nickel can be prepared in the dry way, in a state of purity sufficient for analysis.—On the acidimetric value of the substituted malonic acids, compared with those of the corresponding normal diacids, by M. G. Massol. A thermochemical paper.—On the individuality of seminase, a soluble ferment secreted by leguminous seeds during germination, by MM. Émile Bourquelot and H. Hérissey. The presence of the new ferment, together with a little diastase, was shown in germinating seeds of fenugrec and lucerne.—Influence of a parasite upon its host, by M. C. Sauvageau.—On the first fossil plant sent from Madagascar, by M. Ed. Bureau. The fossil is a new species of *Equisetum*, which, as it was discovered by Dr. Joly, is named *Equisetum Jolyi*.—On the phenomena of metamorphism and the production of an iron mineral coinciding with the denudation of the plateau of Haye (Meurthe-et-Moselle), by M. Bleicher.—On a new group of homogeneous enclosures in volcanic rocks, microtinites, andesites and tephrites, by M. A. Lacroix.—Atmospheric optical phenomena observed at the Pic du Midi and at Bagnères, by M. Em. Marchand.—New observations on the relative wind in a balloon, by M. G. Hermite.—On the production of secondary X-rays by the human body, and on an important point of technique in radiography, by M. Th. Guilloz.—The movements of expired air during the formation of speech sounds, by M. E. Gellé. It is concluded, from the experiments given, that the intra-buccal cavity is not inert, and that the buccal cavity does not act as a resonator as is usually supposed.—On the mechanism of audition of sound and on some connected phenomena, by M. Firmin Larroque.—On a granite from the Pyrenees, by M. F. Larroque.

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 15.

ROYAL SOCIETY, at 4.30.—The Genesis and Development of the Wall and Connecting Threads in the Plant Cell. Preliminary Communication: W. Gardiner, F.R.S.—Photography of Sound Waves and the Kinematographic Demonstration of the Evolutions of Reflected Wave-fronts, with Especial Reference to the Relation of the Wave-front to the Caustic: Prof. R. W. Wood.

ROYAL INSTITUTION, at 3.—Modern Astronomy: Prof. H. H. Turner, F.R.S.

LINNEAN SOCIETY, at 8.—Photography of British Plants: J. C. Shenston.—A New Land Planarian from the Pyrenees: Dr. R. F. Scharff.

CHEMICAL SOCIETY, at 8.—(1) Ammonium Amidosulphite; (2) Products of Heating Ammonium Sulphites, Thiosulphates and Trithionate: Edward Divers and Masataka Ogawa.—Note on the Refraction and Magnetic Rotation of Hexamethylene: Dr. S. Young, F.R.S., and Emily C. Fortey.—The Combination of Sulphur Dioxide and Oxygen: Edward J. Russell and Norman Smith.—Note on the Estimation of Gases containing Sulphur: E. J. Russell.—(1) Apiin and Apigenin. II. Note on Vitexin; (2) The Yellow Colouring Principles of various Tannin Matters, VII.: A. G. Perkin.

FRIDAY, FEBRUARY 16.

ROYAL INSTITUTION, at 9.—Life in Indo-China: H. Warington Smyth.

EPIDEMIOLOGICAL SOCIETY, at 8.30.—Insanitary Property and Workmen's Dwellings in Liverpool: Dr. E. W. Hope.

MONDAY, FEBRUARY 19.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Journeys in the Chinese Shan States: F. W. Carey.

VICTORIA INSTITUTE, at 4.30.—African and Mediterranean River Valleys: Prof. Hull.

TUESDAY, FEBRUARY 20.

ROYAL INSTITUTION, at 3.—Structure and Classification of Fishes: Prof. E. Ray Lankester, F.R.S.

ZOOLOGICAL SOCIETY, at 8.30.—On the Marine Fauna of Christmas Island (Indian Ocean): C. W. Andrews and others.—On the Soft Anatomy of the Musk-Ox (*Ovibos moschatus*): Dr. E. Lönnberg.—On a Species of Earthworm from Western Tropical Africa belonging to the Genus *Benhamia*: F. E. Beddard, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Papers to be further discussed:* Moving Loads on Railway Underbridges: W. B. Farr.—Note on the Floor System of Girder Bridges: C. F. Findlay.—*Paper to be read, time permitting:* Corrosion of Marine Boilers: John Dewrance.

ROYAL STATISTICAL SOCIETY, at 5.

ROYAL PHOTOGRAPHIC SOCIETY, at 8.—The Diffraction Process of Colour Photography: Prof. R. W. Wood.

WEDNESDAY, FEBRUARY 21.

GEOLOGICAL SOCIETY, at 8.—The Bunter Pebble-Beds of the Midlands and the Source of their Materials: Prof. T. G. Bonney, F.R.S.—On Further Evidence of the Skeleton of *Eurycarpus Oweni*: Prof. H. G. Seeley, F.R.S.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Report on the Phenological Observations for 1899: Edward Mawley.—Results of Percolation Experiments at Rothamsted, 1870–99: Dr. Robert H. Scott, F.R.S.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Exhibition of Photomicrographic and Projection Apparatus (with Lantern Illustrations): J. W. Measures.

THURSDAY, FEBRUARY 22.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Total Eclipse of the Sun, January 22, 1898. Observations at Viziadrug: Sir N. Lockyer, K.C.B., F.R.S., Captain Chisholm-Batten, and Prof. Pedler, F.R.S.—Preliminary Note on the Spectrum of the Corona, Part II.: Sir N. Lockyer, K.C.B., F.R.S.—On the Structure of Coccospheres and the Origin of Coccoliths: Dr. H. H. Dixon.—The Ionisation of Dilute Solutions at the Freezing Point: W. C. D. Whetham.

ROYAL INSTITUTION, at 3.—Modern Astronomy: Prof. H. H. Turner, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Standardisation of Electrical Engineering Plant: R. Percy Sellon. (Adjourned Discussion.)

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Improvements in the Longworth Power-Hammer: Ernest Samuelson.—Portable Pneumatic Tools: Ewart C. Amos.

FRIDAY, FEBRUARY 23.

ROYAL INSTITUTION, at 9.—Recent Studies in Gravitation: Prof. J. H. Poynting.

PHYSICAL SOCIETY, at 5.—Prof. R. W. Wood will exhibit and describe his Photographs of Sound Waves and the Kinematographical Demonstration of the Evolutions of Reflected Wave-fronts: a New Seudoscope: Diffraction Colour-Photographs; Artificial Parhelia.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Bearing Springs: B. Humphrey and H. E. O'Brien.

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